GEPHE SUMMARY

Gephebase Gene
opsin - (SWS1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^opsin - (SWS1)^#gephebase-summary-title)

GepheID
GP00001704

Entry Status
Published

Main curator
Courtier

PHENOTYPIC CHANGE

Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait
Color vision (violet-shift) (https://www.gephebase.org/search-criteria?/and+Trait=^Color vision (violet-shift)^#gephebase-summary-title)

Trait State in Taxon A
Other fishes

Trait State in Taxon B
Lambda-max = 423 nm ; violet sensitive
scabbard fish

Ancestral State
Taxon A

Taxonomic Status
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intergeneric or Higher^#gephebase-summary-title)

Taxon A

Latin Name
Actinopterygii (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Actinopterygii^#gephebase-summary-title)

Common Name
ray-finned fishes

Synonyms
Actinopterygi; ray-finned fishes; fish; fishes

Rank
superclass

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi

Parent
Euteleostomi (bony vertebrates) - (Rank: no rank) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 117571)

NCBI Taxonomy ID
7898 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7898)

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Lepidopus fitchi (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Lepidopus fitchi^#gephebase-summary-title)

Common Name
-

Synonyms
Lepidopus fitchi Rosenblatt & Wilson, 1987

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Pelagiaria; Scombriformes; Trichiuridae; Lepidopodinae; Lepidopus

Parent
Lepidopus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 107244)

NCBI Taxonomy ID
515182 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 515182)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
OPN1SW

Synonyms
BCP; BOP; CBT

String
9606.ENSP00000249389 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 9606.ENSP00000249389)

Sequence Similarities
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.

GO - Molecular Function
GO:0038023 : signaling receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0038023)
GO:0008020 : G protein-coupled photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008020)

UniProtKB Homo sapiens
P03999 (http://www.uniprot.org/uniprot/P03999)

GenebankID or UniProtKB
()

GO - Biological Process

GO:0007165 : signal transduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007165)
GO:0007186 : G protein-coupled receptor signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0007186)
GO:0001523 : retinoid metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0001523)
GO:0018298 : protein-chromophore linkage
(https://www.ebi.ac.uk/QuickGO/term/GO:0018298)
GO:0007601 : visual perception (https://www.ebi.ac.uk/QuickGO/term/GO:0007601)
GO:0071482 : cellular response to light stimulus
(https://www.ebi.ac.uk/QuickGO/term/GO:0071482)
GO:0007602 : phototransduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007602)

GO - Cellular Component

GO:0005887 : integral component of plasma membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0005887)
GO:0001750 : photoreceptor outer segment
(https://www.ebi.ac.uk/QuickGO/term/GO:0001750)
GO:0097381 : photoreceptor disc membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0097381)

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

Coding (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title)

Aberration Type

Deletion (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Deletion^#gephebase-summary-title)

Deletion Size

1-9 bp

Molecular Details of the Mutation

deletion of Phe86 (3-bp deletion)

Experimental Evidence

Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)

Main Reference

Evolutionary replacement of UV vision by violet vision in fish. (2009) (https://pubmed.ncbi.nlm.nih.gov/19805066)

Authors

Tada T; Altun A; Yokoyama S

Abstract

The vertebrate ancestor possessed ultraviolet (UV) vision and many species have retained it during evolution. Many other species switched to violet vision and, then again, some avian species switched back to UV vision. These UV and violet vision are mediated by short wavelength-sensitive (SWS1) pigments that absorb light maximally (lambda(max)) at approximately 360 and 390-440 nm, respectively. It is not well understood why and how these functional changes have occurred. Here, we cloned the pigment of scabbardfish (Lepidopus fitchi) with a lambda(max) of 423 nm, an example of violet-sensitive SWS1 pigment in fish. Mutagenesis experiments and quantum mechanical/molecular mechanical (QM/MM) computations show that the violet-sensitivity was achieved by the deletion of Phe-86 that converted the unprotonated Schiff base-linked 11-cis-retinal to a protonated form. The finding of a violet-sensitive SWS1 pigment in scabbardfish suggests that many other fish also have orthologous violet pigments. The isolation and comparison of such violet and UV pigments in fish living in different ecological habitats will open an unprecedented opportunity to elucidate not only the molecular basis of phenotypic adaptations, but also the genetics of UV and violet vision.

Additional References

RELATED GEPHE

Related Genes

9 (Green-sensitive opsin (RH2), Rhodopsin (RH1), opsin - rhodopsin (LWS), opsin - (SWS2), opsin - (SWS2B), Rx1, opsin - rhodopsin1 (RH1), opsin - rhodopsin1-A (RH1-A), opsin - rhodopsin1-B (RH1-B)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7898^/and+Trait=Color vision/or+Taxon ID=^515182^/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS